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RE: Review

**PROPOSED ADOPTION OF CARPETS AND RUGS CONTAINING
PERFLUOROALKYL OR POLYFLUOROALKYL SUBSTANCES AS A
PRIORITY PRODUCT**

This review relates to the proposed regulation in the State of California by the Department of Toxic Substances Control (DTSC) to adopt *carpets and rugs containing perfluoroalkyl and polyfluoroalkyl substances* as a Priority Product under the Safer Consumer Products regulatory framework. To the best knowledge of this reviewer, this is the first regulation of its kind in the United States.

As part of this regulatory process, the DTSC is required to ensure that all product chemical combinations proposed as Priority Products meet the following criteria:

- There is potential for exposure to the Candidate Chemical(s) in the product, and
- Exposures may contribute to or cause significant or widespread adverse impacts to people or the environment.

My expertise in the field is directly relevant to the determination of fate, transport and sources of perfluorinated alkyl substances (PFASs). Thus this review focusses on Conclusion 1 outlined in the proposed regulation:

Conclusion 1:

Humans and biota may be exposed to members of the class of perfluoroalkyl and polyfluoroalkyl substances (PFAs) including perfluoroalkyl acids (PFAAs) through the manufacturing, normal use, handling, recycling, or disposal of carpets and rugs that contain these chemicals.

This reviewer deems that the scientific portion of the proposed regulation as it pertains to Conclusion 1 is based on sound scientific knowledge, methods and practices. The extensive literature review compiled by DTSC and summarized in the report, "ProductChemical Profile for Carpets and Rugs Containing Perfluoroalkyl or Polyfluoroalkyl Substances" outlines over a decade worth of scientific peer reviewed studies examining investigations into the physical

properties, transport, sources and fate of these persistent contaminants. Many of these studies have been performed by leading scientists in the field of perfluorinated chemical research. These investigators have extensive publication record, amounting to years of work providing needed data on these contaminants since the field began to gain ground in the early 2000. In addition, the report summarizes important carpet and rug industry data as well as most updated information available in the published literature as it pertains to toxicity effects, mechanism and exposure routes of these chemicals.

DTSC's proposed regulation using a chemical class approach to PFAS is comprehensive bold, and ultimately radical. No other regulatory body has proposed this holistic approach to these ubiquitous contaminants and their application on carpets and rugs. This approach is supported by many scientific studies that demonstrate the behavior of these compounds in the environment leading to potential exposure to humans and biota are similar driven by the shared characteristic - the perfluorinated backbone. Fluorochemical companies have been reported to have taken advantage of the various chemical handles or end groups leading to vast array of compounds that share a similar chemical backbone. The various end groups were designed and synthesized in order to facilitate a wide array of marketable applications to render surfaces both soil and water repellent. The end groups are useful in various synthetic applications to form surfactants, monomers, oligomers and even polymeric material. There is consistent scientific evidence amply cited by the report that the persistence of these contaminants is due to the strong carbon fluorine bonds that comprise these compounds – these bonds are the strongest as measured by high bond energies.

The justification presented by DTSC on this class approach is based on sound evaluation of the current available data and information from published scientific studies as well as potential hazard still unknown from exposure to chemical mixtures and aggregates that is the common state and use of these compounds. It should be noted however, that this comprehensive regulatory approach poses concerns as to limiting and ultimately disincentivizing the fluorochemical industry from potentially pursuing any improvements in the chemical synthetic process that could lead to better performance, decreased potential toxicity, decreased persistence of these effective surface-active compounds.

It is recommended that the report cites additional work relating to studies that investigate various analytical methods and how their application in the analyses of various products known to contain fluorochemicals show a "total organic fluorine" signature that far exceeds the signature attributable to the known number of chemicals currently being studied (or even identified in the report). Thus, further supporting the data that more than 4730 compounds are present in the market and majority of them are unidentified. Clearly, these unidentified

compounds pose potential risk to the environment and biota. The techniques that have been used and applied in recent investigations include total oxidizable precursor (TOP) assay, high resolution mass spectrometry (HRMS) analysis, nuclear magnetic resonance (NMR) spectroscopy, particle induced gamma ray emission (PIGE) and adsorbable organofluorine (AOF) analysis.

The supporting statements for Conclusion 1 outlined by the DTSC are all based on available scientific data and/or reliable information provided by industry.

In the summary section of the Product-Chemical Profile on page 7, it is suggested to note or add that due to the “persistence of PFASs and the lack of a natural degradation route, their levels in the environment, humans or biota may continue to rise for as long as PFASs are produced and used in consumer products” and for even longer even after these compounds have ceased production. The physical properties of these compounds render them hydrophobic to a point that they partition into sediments and soils and thus these matrices may serve as both sinks and sources for these contaminants. This is what is currently observed with some legacy pollutants such as PCBs. The proposed regulation nor the Product Chemical profile fail to address or make note that another potential human exposure route could be through dermal exposure from treated textiles, clothing, carpet, rugs and upholstery for the general population during its normal use. It is likely that the physical properties of replacement short chain compounds lend itself to being absorbed/adsorbed on skin. This may not have been plausible for the longer chain due to their physical properties.

On page 15 of the Product-Chemical profile, it is suggested to add that in general shorter chain PFASs are liquid at room temperature. 6:2 FTOH was noted to be in this physical state however, 4:2 FTOH is also liquid at room temperature.

The report minimally addresses environmental justice issues that is linked to these contaminants due to the inadvertent increase in exposure and thus increase probability of adverse health effects on residents of low-income communities where manufacturing facilities or incinerators are often located. Also, residents in remote regions including the artic who do not use products or materials that incorporate these chemicals are also exposed due these contaminants as a consequence of their persistence and ability to be transport over long distances via the atmosphere or via ocean currents. There is an opportunity in this proposed legislation to highlight these environmental justice issues especially as this product-chemical combination (Carpet, rug-PFASs) many may argue is not deemed essential to improvement of human health.

Section 3 of the Product-Chemical profile provides clear, logical evidence and supporting information of factors that contribute to potential exposure to the

candidate chemicals from carpets and rugs. It is unclear, or perhaps beyond the scope of this external review the justification for the limited scope of the regulation to carpets and rugs used in indoor residential and commercial locations and to exclude those used or applied in transportation. The report included highly relevant data on carpet production volume, estimated lifetimes and disposal volume and endpoints.

It is recommended that the report in their discussion of “use scenarios contributing to adverse impacts” (Section 3.2.2) include mentioning potential impact(s) of carpet steaming practices – often done by homeowners with in home units or done by vendors who do in home service. Often these practices incorporate use of heat or detergents that may increase the potential for release of PFASs from carpets or rugs.

Extensive evidence was provided summarizing the potential exposures to the candidate chemical from carpets and rugs. PFASs occurrence in the environment is well documented and thus is now widely accepted to be a ubiquitous contaminant.

On page 44 of the report, a typographical error was found in the WWTP effluent section (last sentence – “subsequently” should be change to subsequent.

Perhaps an improvement to the report and to the justification of the regulation in general is to include additional California specific data on detection of PFASs from WWTP effluent, landfill leachate or other biological matrices including breastmilk. If this information is available it would be highly relevant or if it is lacking needs to be mentioned. This was provided to some extent for wild life and drinking water

Sound scientific data were used to support the critical issue of exposure of sensitive subpopulations such as children who spend more time in contact with carpets in rugs at their early life stage. Section 3.3.3 includes a summary of available data on exposure of toddlers to PFASs from dust particles. It may be impactful to do a comparative (hypothetical) calculation of exposure from dust particles for toddlers to that of the recommended lifetime total health advisory of 70 ng/L.

BIG PICTURE comments:

The report follows a logical presentation of the relevant information justifying the proposed regulation. It may be useful to include in the report what assessments are needed when alternative chemicals are being proposed. What would that

process look like as part of the regulation? Some description of this was included but not fully developed or clarified in the report. Interspersed in the review above are aspects where suggestions for improvements can be made in order to strengthen the evidence or the justification.

As indicated above, this proposed regulation though bold is very much needed. It might be worthwhile however to think about whether this regulation prevents incorporation of any possible future chemical improvements or developments. The reason being is, there has been studies where the C8 chemistry has been known to perform the best as far as its surface activity. In other words, the optimum performance for this class of chemicals is observed for those containing at least 8 carbons where the optimum critical micelle concentration is achieved. Thus, it has been a potential issue whether shorter chained replacements perform at the same level as its predecessors. But what if down the road, synthetic processes are developed where better binding of compounds can be done onto the fibers for the C8 compounds? Would this regulation then prevent, what some may argue, are better performing materials and products from being available in the state of California? How will the implementation of this regulation look like for materials imported from other countries? Are their validation requirements on what is on or not on the carpets? These questions are part of the big picture and may or may not be within the scope of this requested review.